PARASITES
OF
HOGS, SHEEP, CATTLE AND POULTRY.

CONTENTS

	Page
General rules as to prevention of parasitism,	5
Parasites of Hogs,	6
Lousiness,	7
Mange,	8
Intestinal worms,	10
Lung worms,	10
Measles,	11
Parasites of Sheep,	12
Scab,	12
Ticks,	14
Grub in the Head,	16
The Stomach Worm,	17
Lung Worms,	21
Nodular Disease of the Intestines,	23
Tapeworms,	23
Flukes,	23
Parasites of Cattle,	24
The Warble Flies,	24
Lousiness,	26
Scab,	29
The Stomach Worm,	30
Lung Worms,	30
Nodular Disease of the Intestines,	31
Tapeworms,	31
Parasites of Poultry,	31
The "Little Red Mite,"	31
Bedbug,	32
Fowl Tick,	32
Lousiness,	34
Scaly Leg,	35
Depluming Mange,	36
Gapes,	37
Intestinal Worms,	38
Coccidiosis,	39
Blackhead of Turkeys,	40

ANIMAL PARASITES.

A few General Notes as to Prevention.

All animals, wild and domestic, may harbor parasites.

When animals are kept in domestication the conditions are more favorable to the propagation of parasites. This is due to housing, closer contact, warmth and other causes. Unthriftiness, stunted growth and frequently death result from parasites. The losses from this source amount to hundreds of thousands of dollars annually in the State of Pennsylvania alone. In view of the fact that it can be prevented, such a condition is wasteful and unnecessary.

We have two general kinds of parasites to deal with: those which inhabit the skin, as lice and mites, and the internal parasites, mostly worms, which live in the stomach and intestines, air passages of the lungs and other internal parts.

The following are a few general rules which will go a long way toward protecting livestock from parasites:

1. QUARTERS—Crowded, unclean and over-heated quarters favor all forms of parasitism, both by contact of the bodies of animals harboring them, and by affording good conditions for the development of parasitic eggs and larvae. Clean out all collected litter and rubbish; have floor dry as possible; let in plenty of air and sunlight; remove manure to fields at short intervals: repeated application of whitewash will be of much service.

2. GROOMING—Collections of dirt and scaly material from the skin attract such parasites as lice and scab mites. Stabled horses should be curried and brushed at least once a day to clear the collected dirt and scurf from their coats and promote the normal skin activity. Cattle when stabled should be brushed daily. If skin parasites are already present, care should be taken that they are not carried from animal to animal by harness, clothing, grooming utensils, etc.

3. PASTURES—The eggs and larvae of the lung worms and the stomach and intestinal worms develop best in moist and wet places at seasonable summer temperatures. Keep animals, especially sheep and calves, on pastures where they will not have access to marshy ground or standing water. Avoid pasturage subject to overflow. Where practicable pasture rotation will help to reduce the prevalence of these parasites.

4. REMEDIES—In most of the parasitic diseases treated of in this bulletin some simple remedies are given which may be applied

by the stock owner. Others given, as preparations for the treatment of intestinal and stomach worms and dips, require a knowledge of the action of the ingredients and experience in compounding. In consideration of safety, they should only be prepared under the direction of one trained for this work. The expense of such service in determining the condition to be treated, prescribing and administering the treatment, and in advice as to checking the spread of the infestation, is slight as compared with losses which may occur if the whole procedure is undertaken by one unfamiliar with the details involved.

All remedies available for destroying parasites are poisonous to the animal treated. The dose must be carefully regulated so that, while of sufficient action to destroy or expel the parasites, it will do the least possible injury to the animal.

It should be borne in mind that dosing animals with drugs with a view to the expulsion of their parasites is of less importance than attacking the eggs and larvae of the parasites which are outside of the animal's body ready to re-infest and perpetuate the condition.

In order to successfully combat the parasites one must know the life history of the particular species concerned and how it is propagated. No parasite will spring up spontaneously, but when a few have been introduced they will multiply rapidly. If such parasites as stomach worms, worms of nodular disease, and tapeworms have become so numerous in a flock that the health of individuals is impaired, it is doubtful whether the parasites can be gotten rid of or kept in check under practical farm conditions even by those most skilled in the subject of parasitology and veterinary medicine. In such cases only extreme and often inconvenient measures, such as a system of pasture rotation involving frequent changes, can hold out hope of success.

Much can be accomplished in the way of prevention of sheep parasites by the exercise of extreme care in purchasing animals, avoiding in every way possible the bringing of parasites into a flock already free from them. An expert sheep man can usually tell whether or not a flock is infested with parasites. His opinion should be sought when purchases are contemplated. Infested animals turned upon pasture at once spread the infestation and it may very soon become a problem involving considerable expense and inconvenience.

PARASITES OF HOGS.

Considering the importance of their early maturity, hogs suffering from parasites present a condition of much economic importance to the hog raiser. Hogs should be closely observed for evidence of

parasites, and when it is known that they are present, measures to get rid of them should at once be taken. This should be done even though the parasites, either external or internal, appear few in number and the animal gives no evidence of disturbance by their presence.

Parasites multiply rapidly, and through reinfestations by the increasing generations, a neglected and seemingly harmless infestation may become one of proportions involving much loss.

The parasites given below are those which affect the health and productiveness of the hog itself, and are therefore of especial interest to the hog raiser. Those of greater importance to human food sanitation, with which the meat inspector is particularly concerned, are not dwelt upon here.

THE EXTERNAL PARASITES.

LOUSINESS—The skin parasite of hogs most commonly met with in Pennsylvania is the louse. There is but one species of louse *(Haematopinus suis Nitzsch)* infesting these animals, and this is a very large and active blood sucker.

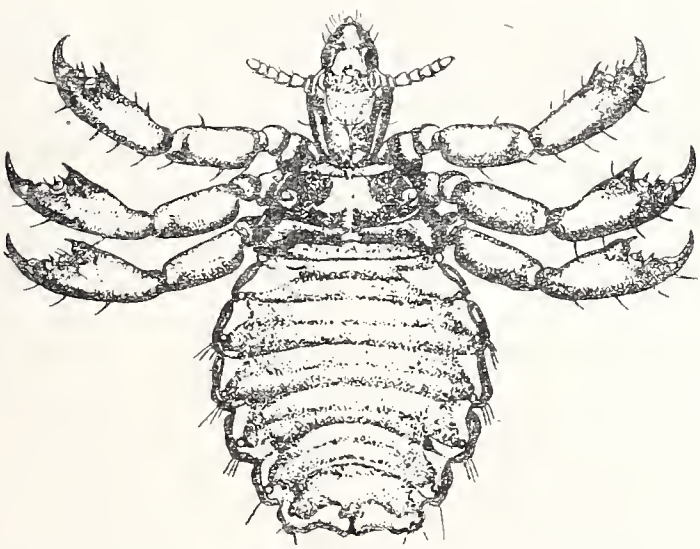


Fig. 1.—The hog louse *(Haematopinus suis)*. Photograph of mounted specimen, enlarged. (Underhill's Parasites and Parasitosis, the MacMillan Co.)

It lives upon hogs of any age, though young animals are likely to suffer the most. They cause constant itching and worry, the restless animals scratching violently against any available object, furnishing thus a source of infestation to other hogs. Under such conditions growth and fattening are checked and young pigs, especially, will

often die from the excessive irritation, loss of blood and lacerations to the skin due to the violent rubbing.

TREATMENT—In attacking this parasite it should be remembered that its entire life from generation to generation is passed upon the body of the hog which it only leaves accidently or to crawl upon the body of another hog. As the eggs are laid by the female they adhere to the bristles, forming the so-called nits, which under a hand glass appear to have somewhat the shape of a barrel. The young are hatched in a few days and grow to maturity upon the hog in about four weeks.

To get rid of the parasites the main reliance must be upon a thorough cleaning up. Essentially, this should be preceded by measures to destroy the lice upon the hogs.

The hog louse is found principally upon the inside, behind and in front of the ears, on the breast and on the inner side of the elbows.

As an insecticide either of the following may be used:

(1) Creolin in five per cent. solution. (2) Kerosene shaken up in an equal quantity of linseed oil. (3) Kerosene, sulphur and lard, equal parts, made into an ointment.

The remedy should be applied freely to the skin over the parts infested. To the fluid preparations it is well to add vinegar the proportion of about half a pint of vinegar to the quart; or it may be applied separately diluted with twice its quantity of water. The vinegar has a destructive action upon the eggs which may escape the action of the insecticide.

Wallows should be treated with a five per cent. solution of creolin. All bedding and litter should be removed and burned, and pens, wood work, posts, trees, etc., upon which the hogs may have rubbed, washed down with a five per cent. creolin solution, followed by an application of whitewash.

The measures of treatment and eradication should be repeated at least three times at intervals of eight to ten days. This is necessary to destroy the lice which may hatch from remaining eggs.

MANGE—In Pennsylvania mange is less commonly met with among hogs than lousiness. Where mange in hogs is recognized, it is most always the sarcoptic form, that is it is due to a mange mite (*Sarcoptes scabiei* var. *suis*) which burrows and deposits its eggs beneath the outer layer of the skin. Sometimes the mite may be seen among the removed scabs as a small moving speck, though it can be much better detected under a magnifying glass.

The disease generally first appears upon the head, about the eyes and ears. From here it spreads to the back of the neck, withers, shoulders, back and later may invade the greater surface of the body.

The itching which it causes is extremely severe and is especially aggravated in animals subjected to the body heat of crowded pens. With the extension of the disease the bristls fall out and the skin become wrinkle and covered with brownish crusts. Fissured and

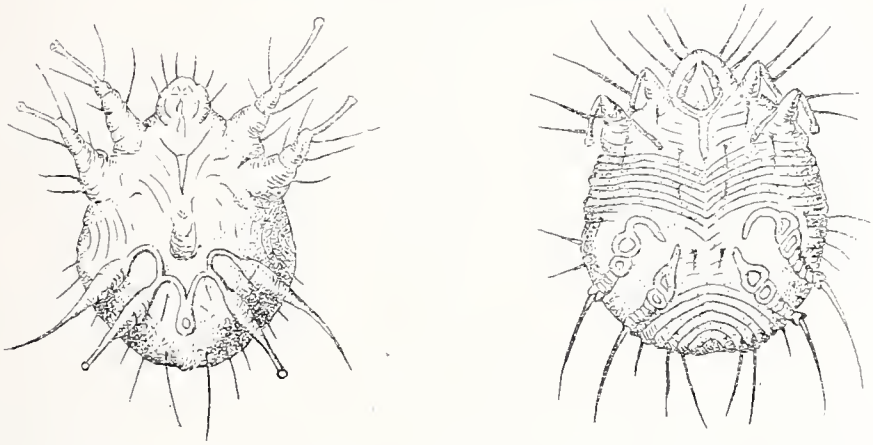


Fig. 2.—The parasite of sareoptic mange (*Sarcoptes scabici*), dorsal (left) and ventral (right) view of female, enlarged. (From Underhill's Parasites and Parasitosis, the Macmillan Co.)

bleeding areas with ulcerations may occur. Young pigs suffer the most. Development and fattening are arrested and severe cases lead to general debility and death.

TREATMENT—Unless dislodged, the parasites live their entire life upon the hogs. Contagion is by contact of the hogs with each other from objects upon which the infested animals have rubbed.

Where but few animals are to be treated they should first be thoroughly scrubbed with soap and warm water and the skin rinsed and dried. Either of the following may then be applied.

(1) Sublimed sulphur two parts, potassium carbonate one part, lard eight parts. (2) Creosote one part, lard twenty-five parts. (3) Sulphur ten parts, lard thirty parts.

In no case should any of these preparations be applied over the entire body at one application. The remedy is to be repeated three times at intervals of about five days.

Where a large number of animals is involved, dipping is the only practical form of treatment. The formula as used in dipping for scabies in sheep is simple and efficient. This should be prepared and carried out only under the direction of one qualified for it by training and experience.

Pens, litter, yards, etc., should be treated in the same manner as recommended for lice, after which the quarters should not be occupied by hogs for eight or ten weeks.

THE INTERNAL PARASITES.

The Common Round Worm of the Intestine (*Ascaris lumbricoides*).

The female of this worm is eight to ten inches in length, with smooth, relatively thick body, and white or yellowish in color. It usually inhabits the small intestine in which it lives free, obtaining its nutriment from the intestinal contents.

These worms cause injury to the animals harboring them by the poisons which are given off from their bodies, by their massing together and forming an obstruction to the intestinal contents, or, as is not uncommon, by their wandering to unusual locations, as the bile duct of the liver, which they may plug up, or where they may cause other disturbances of a fatal nature.

In general the symptoms produced will depend upon the number of worms present. Young pigs are especially likely to be invaded and are the most seriously affected. In moderate to heavy infestations the pigs are unthrifty, there is usually a cough and this may be accompanied by occasional vomiting with perhaps the expulsion of one or more of the worms. The pigs are inclined to wander aimlessly about and may emit cries as if from colicky pains.

TREATMENT—The eggs of the worms are deposited in the intestinal contents of the pig and passing to the outside are taken up by other pigs with their food and water. Reaching the intestine the eggs hatch and the worms develop to maturity.

Individual treatment of infested pigs is difficult and at best unsatisfactory. If medication is resorted to it should be under the direction of a veterinarian.

Isolation and a thorough cleaning up are the measures most to be relied upon. Pens and yards are to be treated as directed for external parasites. Drainage and the source of water supply should not be overlooked as sources of infection. Pigs showing evidences of the presence of the worms should be removed to clean quarters and the quarters thoroughly cleaned out each day, the litter to be burned, buried, or at once spread upon the fields. It is well to have two or three isolation pens so that there may be a separation of pigs showing varying degrees of the infestation.

The LUNG WORMS—The worm usually found as the cause of verminous bronchitis and pneumonia in hogs (*Metastrongylus apri*) is one to two inches in length with a thread-like body. In color it is white or reddish white.

Especially in young pigs, heavy infestations with these worms may occur with high mortality. There is labored breathing, a frequent cough with discharge of frothy mucus which contains the eggs and

embryos of the worms. The pigs rapidly lose flesh and may die from exhaustion or suffocation. Milder cases may show no more than a lack of thrift with occasional cough.

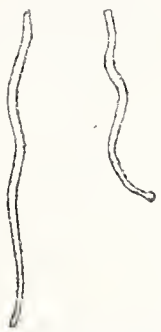


Fig. 3.—Lung worm of the hog *(Metastrongylus apri)*, male (right) and female (left) natural size. (From Underhill's Parasites and Parasitosis, the Macmillan Co.)

TREATMENT—No treatment with medicine or vapor inhalations is practical with pigs. Infestation is by way of food and water contaminated with the larval worms. As the larvae will only develop in the presence of moisture, all pens and runs should be kept dry. The quarters should be thoroughly cleaned and disinfected as directed for other parasites. Pigs showing symptoms of infestation should be removed to isolated pens as directed for intestinal worms. Drainage and a liberal covering of the ground with lime will do much to destroy larvae.

THE THORN-HEADED WORM *(Gigantrhynchus hirudinaceus)*—This is a large, round worm, which may reach a foot or more in length. The head is provided with thorn-like hooks by which it attaches to the lining of the small intestine. Heavy infestations with these worms have not often been reported in Pennsylvania. The worm is of more common occurrence in the South. If in large numbers, they set up inflammatory disturbances in the intestine with accompanying general derangement of digestion.

Infestation is occasioned through the hogs eating the common white grub of the May beetle, which harbors the larval form of the worm.

TREATMENT—Owing to their firm attachment, treatment with a view to expelling the worms is unsatisfactory. Their presence is usually only revealed after slaughtering.

TAPEWORM AND TRICHINA CYSTS—These are small cysts from the size of a pin head to a pea which may occur in the muscles of hogs and constitute the condition known as measles. The tapeworm cysts contain the larvae of a tapeworm of man, the hog be-

coming infected by food or water contaminated with eggs discharged from the excrement of a person harboring the adult tapeworm.

Infection with the trichina cysts is by eating the flesh of other animals, as rats, mice, and other hogs, infested with the cysts.

Where measles exist it is seldom recognized during the life of the animal. It is of more importance to the meat inspector than to the hog raiser.

PARASITES OF SHEEP.

Of all the domestic animals, sheep are the greatest sufferers from parasites, the injury and losses among sheep being greater from this cause than from disease-producing bacteria.

All the worms attacking sheep, where the life history is known, require a certain amount of moisture as well as a favorable temperature for their development outside of the sheep's body. This fact affords us grounds upon which to base measures of prevention, for it is known that these losses can be greatly reduced, if not eradicated entirely, if sheep are kept on dry pasture land without access to standing water or pasturage subject to overflow. This applies to the most destructive of the worm parasites where the development outside of the sheep's body is known.

In dealing with the condition it should be remembered that the sheep parasites, as is true of parasites in general, multiply rapidly and that a seemingly slight and harmless invasion may soon become one involving a serious problem.

Eradication has two objects in view, the expulsion of the parasites from the bodies of the sheep and the destruction of the parasites' eggs and larvae which have passed from the infested animals and are sources of infection.

The parasites given below are those with which the sheep raisers of Pennsylvania are most concerned.

THE EXTERNAL PARASITES.

SHEEP SCAB—This skin disease is particularly a source of trouble among the flocks of our Western States. Where it occurs in Pennsylvania it is generally imported. As at any time there may be a serious outbreak of it in this State, it is important that our flock owners should be made acquainted with some of the more prominent facts relative to the condition.

The disease generally referred to as sheep scab is due to a mite (*Psoroptes communis* var. *ovis*) for the recognition of which the microscope is necessary, though it is possible to see it as a moving speck with the naked eye. (Fig. 4.)

The mites inhabit the surface of the body where the wool is thickest. Here they live in colonies which may spread over uniting areas until the greater part of the back and sides of the body is involved. Mostly the mites are at the base of the wool fibres where the female deposits her eggs from which the young are hatched in three to seven days. The time elapsing from generation to generation will vary according to more or less favorable conditions, but is ordinarily about two weeks.

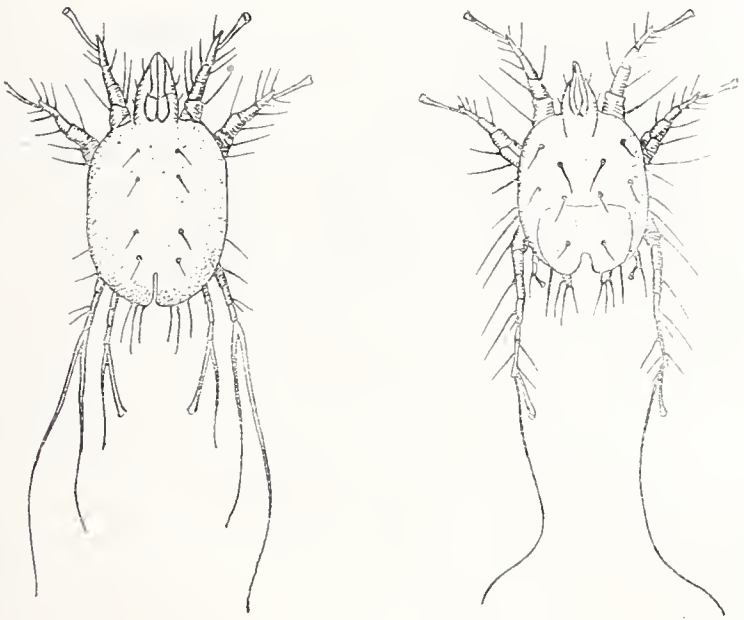


Fig. 4.—The parasite of sheep scab *(Psoroptes communis)*, dorsal (left) and ventral (right) view, enlarged. (From Underhill's Parasites and Parasitosis, the Macmillan Co.)

Early indications of the presence of the mites are unrest and rubbing or gnawing at the wool. Later the wool loosens in tufts and becomes raised over the surface of the fleece which becomes ragged and taggy. The yellowish crusts which are formed increase layer upon layer and mat the wool, lifting the loosened fibers in large bunches and exposing the skin in more or less thickened, furrowed, bleeding condition.

Animals apt to be attacked most severely are lambs and those debilitated by age. In advanced cases there is loss of flesh, anemia, and weakness; such cases, if unchecked, terminating in death. In stabled animals and among lambs the disease may run a rapid course, spreading over the greater part of the body within one or two months, while on the other hand, under better conditions, it may last in a more or less severe form for a year or more.

Psoroptic scabies of sheep cannot be transmitted to other animals, nor can this form of scabies in other animals be transmitted to sheep.

TREATMENT—Where scabies has become established in a flock treatment must be applied with a view to killing the parasites. For this purpose remedies applied by hand are practically useless. Whatever the remedy, it should be applied by dipping.

Most of the published formulas for sheep dips have as their base lime, sulphur, tobacco or arsenic. There are a number of proprietary dips upon the market which will be found convenient and effectual. No dip should be used, however unless the active ingredients and their exact proportion are known to the user. This especially applies to preparations containing such poisons as arsenic, carbolic acid and nicotine. According to the United States Bureau of Animal Industry the nicotine content of a dip containing tobacco should not exceed seven one-hundredths of one per cent. In any case it is an economic precaution to have the entire process of preparation and dipping supervised by some one trained for the work.

Place one-half pound of unslacked lime in a bucket or kettle. To this add enough water to form a paste. Into this paste sift one and one-half pounds of flowers of sulphur and stir the mixture well. Place the sulphur-lime-paste in a kettle with about three gallons of water and boil. The boiling should continue from one to two hours. The solution is then a chocolate or liver color. Water may be added as necessary.

Pour the mixture and sediment into a bucket and allow two or three hours for the sediment to settle, then carefully dip off the clear liquid taking care not to disturb the sediment. Place this liquid in a wooden receptacle or a keg that can be closed tightly to exclude air or in a glass receptacle, such as a demijohn. To the clear liquid thus dipped off add enough water to make six gallons. The sediment should be thrown away.

Bulletins containing plans for dipping vats suitable for small and large flocks may be obtained from the United States Bureau of Animal Industry, upon application to the Superintendent of Documents, Government Printing Office, Washington, D. C. (Fig. 5)

Following dipping it is better not to return the sheep to pastures which they have been upon within six weeks previous to the treatment. If this is impracticable, sulphur should always be an ingredient of the dip, as this remains upon the skin and wool and protects the sheep from reinfection during the period that the parasites may remain infective.

THE SHEEP TICK—This common skin parasite of sheep (*Malophagus ovinus*) is not a true tick, nor is it a louse, but a degenerate

fly which has become wingless and lives its entire life upon the sheep's body, only leaving it accidentally or to crawl upon another sheep. It is widely distributed, and sheep men everywhere are familiar with

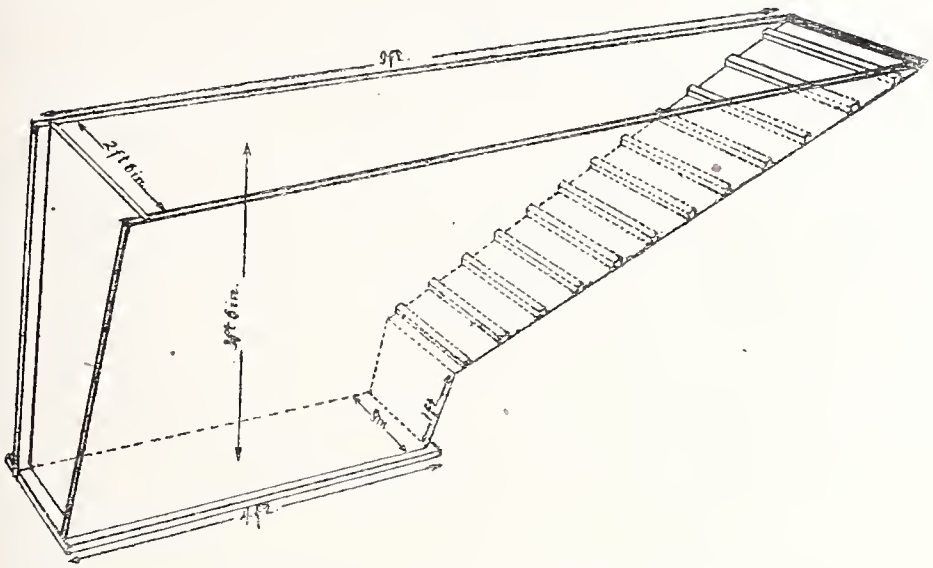


Fig. 5.—A small portable dipping vat. (From Bul. No. 21, Bu. An. Ind., U. S. Dept. Agr.)

it. It is about one-quarter of an inch in length, redish or grayish in color, with small head, large abdomen, and a generally spider-like appearance. (Fig. 6)

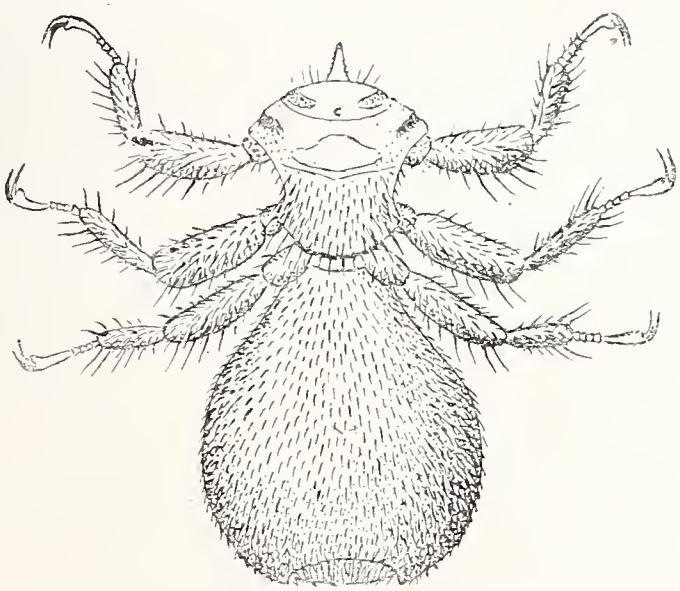


Fig. 6.—The sheep tick *(Melophagus ovinus)*. Drawn from specimen, by R. J. Sim, (enlarged).

The tick has a peculiar method of reproduction by which the eggs are hatched within the body of the female, the larvae passing from

her to be attached to the wool fibers as tiny, reddish brown bodies (pupea). In three to six weeks, the shorter period occuring during the summer months, the insect is released from its protective covering, becomes mature, and deposits its young in the same manner for the succeeding generation. Probably the life of the tick on the sheep will not exceed four or five months. Removed from the sheep it will not survive more than a few days.

The presence of these ticks will not cause serious disturbance, heavier infestations will cause the animal to rub and bite at the fleece. From the irritation, badly infested animals will lose flesh and become generally unthrifty, the fleece becoming tagged and unsightly. At shearing time large numbers of the parasites may leave the sheared sheep to crawl upon the lambs, many of which may die unless promptly relieved.

TREATMENT—As the migration of the ticks occur mostly at the time of shearing when the parasites are removed with the fleece, the lambs should be kept at some distance from the shearing operation and afterward from the stored wool. This precaution should be continued for at least a week following the shearing, by which time the ticks which have been removed with the wool will probably all be dead.

The most effectual time for the destruction of the parasites upon the sheep is after shearing, when such remedies as creolin, zenolium, lysol, or cresol, in two or three per cent. solution, may be applied by dipping or as a wash. The treatment should be repeated in about twenty-four days in order to reach the next generation coming forth from the "nits" which have escaped the first application. If the weather is cool between treatments the interval should be accordingly prolonged.

GRUB IN THE HEAD—The sheep bot fly *(Oestrus ovis* Linn.) deposit its larvae in the nostrils of sheep during the warm months. From here the young grubs make their way to bony cavities of the head where they attach by a pair of hooklets at their head end and develop into mature grubs which may reach to a half to three-quarters of an inch in length. In the following spring months they release from their attachment and are expelled to the ground where, after a stage (the stage of pupation) lasting four to six weeks, they emerge as mature bot flies.

The presence of these grubs in the cavities of the head causes a catarrhal inflammation accompanied by the discharge of a thick mucus which in severe cases may so fill the nasal passages as to threaten suffocation.

The condition is commonly known as "snuffles" or "grub in the head," and from somewhat similar symptoms occasionally presented, it is sometimes confused with gid, a disease of sheep due to the presence upon the brain of the cystic or bladder-form stage of a tapeworm of the dog. Gid has been rarely reported among sheep in the eastern part of the United States.

TREATMENT—Smearing the noses of the sheep with tar during the season of the flies is a method often practised by sheep men for repelling the attach of the bot flies. A convenient method for large flocks is to bore two inch holes an inch or two in depth and about eighteen inches apart in logs. The holes are kept partly filled with salt, and tar is smeared around the margin of each. As the sheep lick the salt their noses become smeared with the tar. The logs should be so placed that all sheep will have access to them.

The only effectual method of getting rid of the grubs in the head is by trephining into the cavities and removing them with forceps, but this is so impractical in a flock as to be scarcely worthy of consideration.

THE INTERNAL PARASITES.

THE STOMACH WORM—Probably of all parasites besetting sheep, this worm has brought the greatest despair to sheep men. The worm *(Haemonchus contortus)* is thread-like, about three-quarters of an inch in length. (Fig. 7). It attaches by its head to the lining of the stomach and sometimes to the intestine, where it sucks blood. Though the worms are small, they may infest the stomach in vast numbers, in such cases causing serious and often fatal injury to the sheep.

Sheep of all ages may be infested with them, but the greatest injury and loss is among the lambs. In heavy infestations the myriads of blood-sucking worms bring about anemia, disorders of digestion, loss of flesh, and dropsy. Swellings may appear in the brisket, under the lower jaw, or in other dependent parts of the body. Later there is diarrhoea with dark, watery and putrid discharge. Such cases usually run a course of several months, during which it may be quickly terminated by death in convulsions or paralysis, or the animal may die in a state of advanced emaciation and weakness.

Where there is doubt as to the cause of these symptoms and a number of the flock is involved, an affected animal may be slaughtered and the fourth stomach laid open and examined. If the condition has been caused by stomach worms they will be found in large numbers fixed to the lining of the stomach and many of them free in the stomach's contents.

TREATMENT—When it is determined that the stomach worm is present in the flock measures should be taken at once to control its spread. Effectual application of such measures demands a knowledge of such facts as are known pertaining to the life history of the parasite.

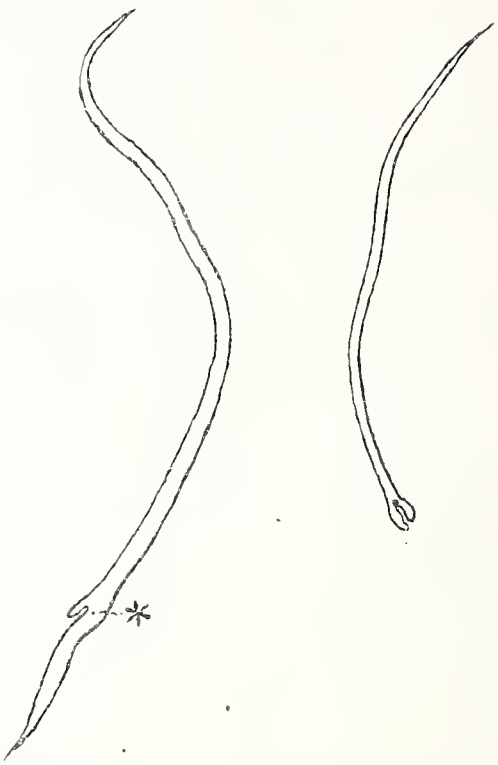


Fig. 7.—Stomach worm of sheep and cattle *(Haemonchus contorus)*, male (right) and female (left) enlarged. (After Ransom, Bul. No. 127, Bu. An. Ind., U. S. Dept. Agr.)

The worm eggs expelled from the infested sheep may hatch in a few hours or in several days or weeks, depending upon conditions of temperature and moisture. If cold (below 40 F.) the eggs will not hatch. Newly hatched larvae require a certain amount of moisture and warmth for their further development, dryness and freezing will kill them. If the larvae survive their early period, they become enveloped in a protective sheath which is derived from the outer covering of the body. They can then survive freezing and drying for a long period, and it is during this stage that they may infect the sheep if taken up with food and water. The larvae at this time are especially active in the presence of moisture, as that from rain or dew, causing them to be more readily taken up under such conditions by the grazing sheep.

It follows that the use of dry, elevated pastures, with good natural drainage, greatly reduces the chances for the larvae to reach their unsheathed stage, the only stage in which they are infective, and consequently the opportunity for reinfection.

Based upon the varying periods, of times required for the newly hatched larvae to reach ensheathment, systems of pasture rotation as a method of control have been recommended. This method, if carried out to effectiveness, involves much fencing and in most cases a considerable reduction of the flock. To most sheep men it is quite impracticable and, therefore, will not be detailed here. Probably the confining of the flock to high and dry land would in the majority of cases better meet the convenience of sheep raisers.

Of the remedies employed for the expulsion of the worms from the infested animals it will be sufficient here to mention two,—gasoline and copper sulphate. Gasoline has afforded a convenient remedy, but the commercial gasoline of the present time is unsuitable for this purpose. At best it has the disadvantage of having to be administered on three consecutive days if it is to be effectual.

HOW TO PREPARE AND ADMINISTER THE BLUESTONE OR COPPER SULPHATE DOSAGE IN THE TREATMENT FOR STOMACH WORMS.

In the preparation of the dose use only clear blue crystals of copper sulphate (Bluestone). Crush the crystals to a fine powder when ready to make up the solution. Dissolve quarter pound (avoirdupois) of the powdered crystals in one pint of boiling water, using a porcelain or enamelware dish as the bluestone will corrode most metals. Then add enough cold water to make the solution up to three gallons, using wooden, earthenware, or other non-metallic receptacle. This will make an approximate one per cent. solution and will be enough to dose 100 adult sheep allowing for about ten per cent. waste.

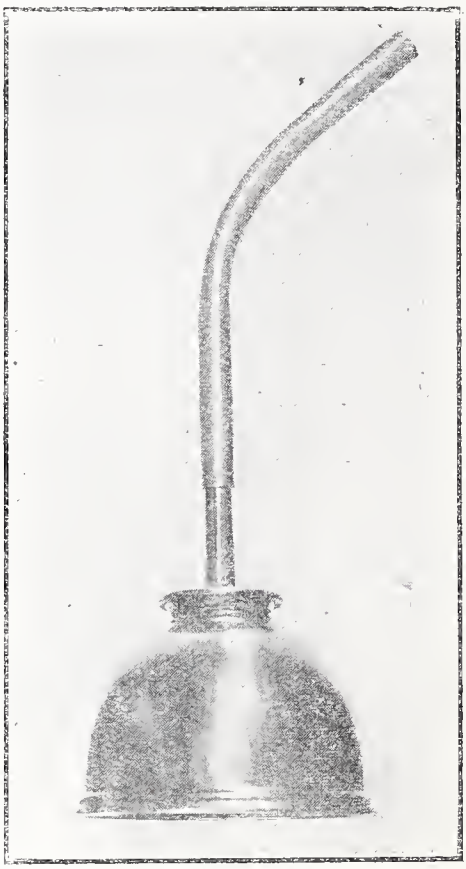
The amounts of the dosage for both old sheep and lambs are:

For lambs under one year of age, 1½ ounces (50 cc)
For sheep past one year old, ... 3 ounces (96 cc)

A glass with marks scratched on the side with a file may be used for measuring the doses. A simple and inexpensive apparatus for administering this treatment is shown in the following cut.

Customarily the treatment is given after the sheep have been starved over night, but apparently may be given with equally good results without preliminary fasting, providing the animals are not gorged with feed or water when treated.

While being drenched the sheep should remain on all four legs with its head held horizontally. This is important for if the head is held above the horizontal point (nose higher than the eyes) there is danger of some of the fluid passing into the lungs, thereby causing



Courtesy, National Stockman and Farmer.
This is made from a common machine oil can. A can with a large opening in the top (1 in. to 1¼ in. in diameter) is easy to put the dose of medicine into. Cut the end off the tin spout at a point where it makes a hole about one-eighth in diameter, slip over this a piece of one-fourth inch gas pipe, or what is commonly used for an extension on gas light fixtures, about three or four inches long. This pipe will prevent the sheep from chewing or crushing the tin spout.

pneumonia and almost certain death. Measure the amount of the dose in the measuring glass. The fluid should not be administered more rapidly than the sheep can comfortably swallow.

Care in the administration of the dose is highly important as carelessness or any undue haste is liable to have serious results. The copper sulphate treatment, like the administration of medicines in general, is safest in the hands of a competent veterinarian.

Probably the best expellant that we have at present for these worms is copper sulphate. This is given in solution of exact per-

centage which must be very carefully prepared and the dosage accurately graded according to age. As a precaution against losses it is essential that this be done by one trained for the work.

THE LUNG WORMS—Most cases of verminous bronchitis and pneumonia of sheep are due to one species of work *(Dictyocaulus filaria)* which is three inches, more or less, in length, white and thread-like (Fig. 8) It lives in the bronchial tubes.

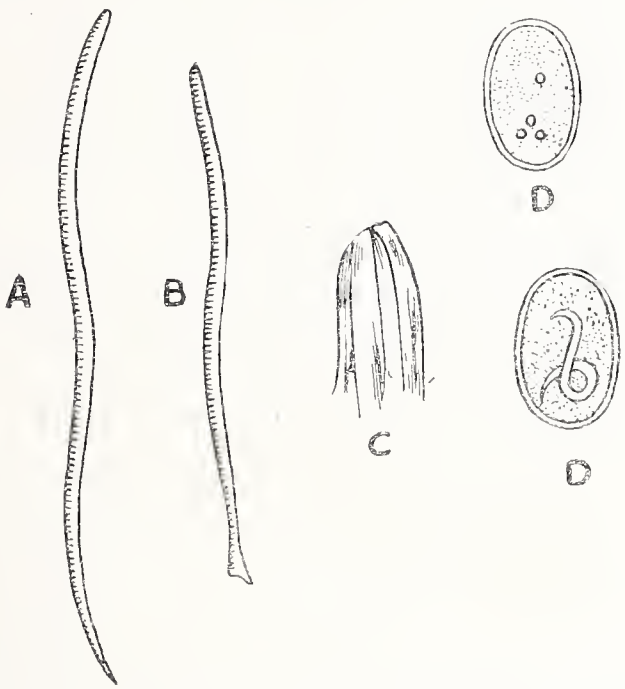


Fig. 8.—Lung worm of sheep (*Dictyocaulus filaria*). a, female; b, male; c, anterior extremity; d, eggs. (From Underhill's Parasites and Parasitosis, the Macmillan Co).

In general, the first indication of the presence of the worms is a short dry cough, which later becomes more frequent and may be accompanied by paroxysms or distressed difficulty in breathing. The material expelled in coughing may be frothy or lumpy and usually contains a few of the worms with their eggs and embryos. In light cases there may be no more than an occasional cough. In heavier infestations the symptoms may pass from those mentioned to extreme difficulty in breathing, loss of flesh, anemia, and swellings in the lower part of the throat, muzzle, eyelids, brisket, or other dependent parts of the body. Soon after the onset of these symptoms the animal may die in complete prostration, or death may occur from suffocation.

The losses are likely to be greatest among the lambs, very young ones sometimes succumbing in a few days from the time symptoms are first observed.

The hatched embryos of the lungworms reach the outside mostly with the material expelled in coughing. If meeting with favorable conditions of warmth and moisture, they undergo a certain development and, retaining a protective covering, resist drying for a considerable period. It is probably in this condition that they are taken up by the sheep with moist grass or water, such as that from shallow collections upon the pastures. From the alimentary tract those finding their way to the lungs mature. Repeated experiments have not been successful in bringing about infection by the introduction of bronchial mucus containing numerous embryos into the respiratory passages, thus indicating that infection cannot take place directly from animal to animal.

TREATMENT—Where lung worms are present the sheep should be confined to elevated pastures free from standing water. It is well to give the flock, especially the lambs, feed and water before they are turned upon the pasture each day. This, in a measure, will prevent them from going to pools and marshy places for water where they are likely to linger and graze unless their night's fast has been previously somewhat broken. Manure contaminated with eggs and larvae should be collected and burned or deeply buried, and infested respiratory organs of slaughtered animals should be disposed of in the same manner.

Fumigation is a method widely practised for expelling the worms from the sheep. The fumes should be administered in a tightly closed building or room to accommodate about fifty lambs at a time. A number of substances may be used to create the fumes, tar, sulphur, and turpentine probably being among the best. These can be used singly or combined, placed upon hot coals contained in a pot suspended by a chain from the ceiling in such manner as to be beyond the reach of the animals' heads. The fumes should fill the entire enclosure and can be maintained by adding more of the ingredients as required. The intensity of duration of the treatment should be governed by the size and vigor of the animals and according as they become accustomed to it. At first a few minutes each day will be sufficient; later two or three treatments of about ten minutes duration each may be given daily.

One objection to the fumigation treatment is that, to be successful, the fumes must be applied until the animals are dangerously close to suffocation. The chances of loss from this source can be greatly reduced by closely observing the animals while being subjected to

the treatment. Immediately upon the appearance of evidence of suffocation doors and windows should be thrown open and any animal which may be in immediate danger quickly removed to the outer air.

Treatment by tracheal injections of liquids designed to kill the worms, or reduce their vitality so they may be easily expelled, is sometimes resorted to. This method is not as practical as fumigation where large flocks are concerned. It can be only applied safely and effectually by a qualified veterinarian, and should never be attempted by any one without this special training.

NODULAR DISEASE—This is so-called from the presence of small protuberances or nodules in the wall of the large intestine, produced by the lodgment there of small worms during a stage in their development. The disease is common in the United States, usually caused by the species *Oesophagostomum columbianum,* which in its adult state is about five-eighths of an inch in length.

Many slaughtered sheep that were apparently perfectly healthy show these nodules, nevertheless, nodular disease may assume an enzootic character of severe type with numerous losses. In such cases there is usually heavy infestation, large areas of massed nodules showing on the intestinal wall upon post-mortem.

The course and termination of the disease will depend upon the age and vitality of the affected animal as well as upon the degree of the infestation. Severe cases may terminate fatally in two or three months, preceded by diarrhoea, loss of flesh, and anemia.

TREATMENT—Natural infection probably occurs by food and water contaminated with the worm larvae, which, on reaching the large intestine, at once penetrate into its wall. Later they pass back into the cavity of the intestine where they become mature and deposit their eggs, these passing from the sheep with the droppings.

There is no effective medical treatment for these worms. The only treatment is preventive. As lambs suffer the most seriously, they should be protected as far as possible from infestation by placing them in a dry, uncontaminated lot where they should be fed and watered from racks and troughs which are sufficiently elevated that the contents cannot be soiled by droppings from the nursing ewes.

OTHER PARASITES—The parasites mentioned above are those commonly met with in Pennsylvania and other parts of the Eastern United States. Several species of tapeworm are commonly found in the intestines of our Eastern sheep, though the most harmful one—the fimbriated tapeworm—seems to be confined to the flocks of the Western States. Flukes and the gid parasite may constitute a

very serious source of loss to sheep owners, but these up to the present time at least, are rarely reported in this State.

PARASITES OF CATTLE.

PARASITES OF THE SKIN—The Ox Botflies or Warble Flies.—During the spring and early summer months, where these flies are prevalent, cattle may be much annoyed by their attacks. There are two species, *Hypoderma lineata* (Fig. 9) and *Hypoderma bovis* (Fig. 10), the latter said to frighten cattle much more than the former.

Fig. 9.—Ox Warble fly *(Hypoderma lineata)*, enlarged, original.

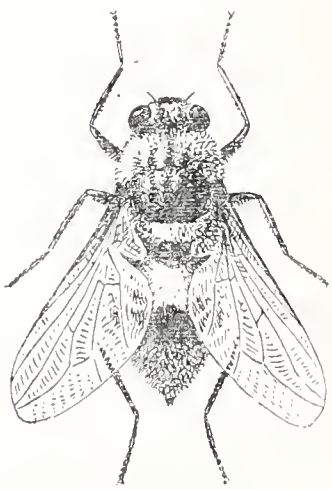


Fig. 10.—Ox Warble fly *(Hypoderma bovis)*, enlarged, original.

Though they endeavor to escape the attack of these flies may cause injury to cattle through their entering mire holes, or in other

ways, the principal damage is not from the attack of the flies, but from the lodgment of their larvae or grubs just beneath the skin of the back where their presence may be recognized by elevations of the skin into rounded, somewhat hard tumors, which, according to the development of the grub, may be from the size of a hazel nut to that of a hen's egg. Examination of the enlargement will generally reveal a small quantity of flaky pus at its summit, beneath which there is a puncture of the skin leading to the posterior extremity of the encapsulted grub. The damage imparted to hides in the United States from these punctures is, in the aggregate, said to be enormous.

The flies appear in the spring months, though, unlike the botfly of the horse in this respect, they are seldom seen. At this time the female deposits her eggs upon the hairs of the cattle, the attachment of the eggs to the hair being accomplished by a clasp-like process extending from an extremity of the egg. In about one week the eggs hatch, and the tiny worm-like larvae proceed to bore through the skin. From here they pass through a complicated series of migrations within the body of their host.

During the following midwinter months they make their appearance in the tissue beneath the skin of the back, evidenced by small lumps which may be readily felt with the hand. At this time the larvae mhich were less than one-sixteenth of an inch in length when hatched have grown to a length of half an inch or more. Thus lodge, they feed upon inflammatory porduct createdby their presence, grow and produce the characteristic swellings already referred to. At maturity the larvae leave the tumors and pass to the ground. This may occur at any time from the early part of the year to early summer, at which time the larvae have developed into fat, yellowish-white grubs an inch to an inch and a quarter in length and about a half inch in thickness. The mature grubs now secrete themselves usually for a short distance in the ground, and enter the quiescent or pupal stage from which they emerge a few weeks later as adult warble flies. In the adult state the flies do not feed and their life is short, the entire adult activity being devoted to reproduction of the species.

TREATMENT—Protection against the attacks of the flies is scarcely practicable, cattle out of doors are necessarily exposed to them during the months of the insects' activity.

When the grubs have become sufficiently developed in the backs of the cattle, substances, such as a little kerosene, kerosene and lard, or mercurial ointment may be inserted deep into the openings at the summits of the tumors. This will destroy the grubs, when they

may be removed by careful pressure from below. Grubs which have been thus removed, and which may still be living, should be at once destroyed to prevent their possible development into adult flies.

LOUSINESS—Cattle, like other domestic mammals, harbor two kinds of lice, those which pierce the skin and suck blood, and those in which the mouth parts are adapted for biting only. These resemble each other in general form, the difference being mainly one of size and proportion parts. The sucking lice are the larger, and the head and mouth parts project forward, the head, relative to body parts, following, being more narrow. The biting lice have the mouth pieces beneath a head which may be as broad as long; broader than the parts following.

Through their puncture, the sucking lice cause the greater irritation and itching of the skin. Two species of sucking lice are to be mentioned as infesting cattle—*Haematopinus eurysternus* (fig.11) and *Linognathus vituli* (fig. 12) the latter smaller, more slender, and often referred to as the long nosed ox louse from its elongated head parts. Cattle have but one species of biting louse, *Trichodectes scalaris* (fig. 13) which may readily be distinguished from the others by its broad, triangular-shaped head with rounded corners.

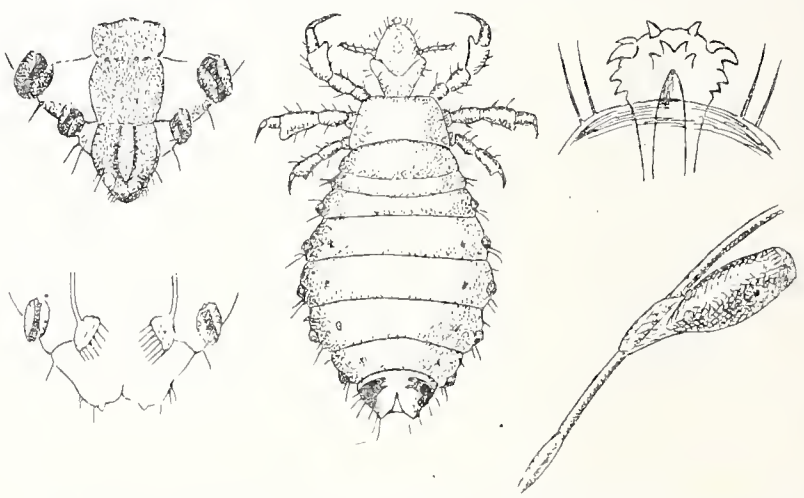


Fig. 11.—Sucking louse of cattle *(Haematopinus eurysternus)*; a, female; b, piercing mouth parts; c, last segments of male; d, same of female; e, egg, (nit) attached to hair, all enlarged. (After Osborn, Bul. No. 5, Bu. of Entomology, U. S. Dept. Agr.)

It is probable that biting lice occur more frequently upon these animals is usually accompanied by less itching than is this condition among other animals, as the horse, where the sucking species predominates. The biting louse may be found upon most any part of the body of an infested animal, frequently crawling out upon the hairs.

Both the short and long nosed sucking species are more often found about the base of the head, ears and along the upper part of the neck and back. Wherever the lice may be located their presence is indicated by their eggs, which appear as minute specks glued to the hairs, commonly referred to as nits. Other indications are the itching and the debris of the skins shed by the insects.

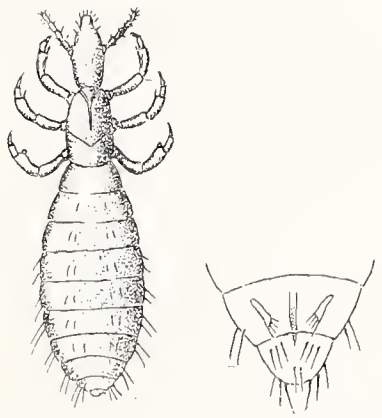


Fig. 12.—Sucking louse of cattle *(Linognathus vituli)*, female, enlarged. (After Osborn, Bul. No. 5, Bur. of Entomology, U. S. Dept. Agr.)

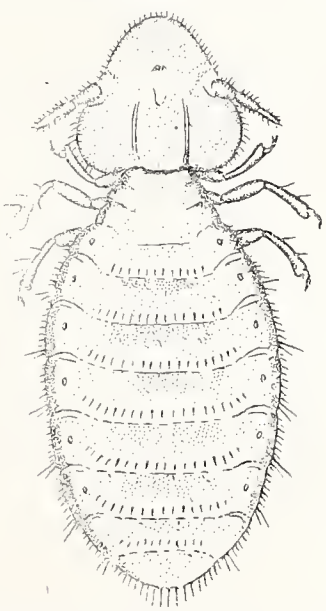


Fig. 13.—Biting louse of cattle *(Trichodectes scalaris)*, enlarged. (After Osborn, Bul. No. 5, Bu. of Entomology, U. S. Dept. Agr.)

Lousiness of cattle is most apt to appear toward the close of the winter months, when the concentration of the animals by stabling or yarding affords in numerous ways facilities for the spread of the parasites. In many cases, furthermore, the cattle have been upon

"dry feed" for a prolonged period, as a result of which the skin functions are less active, the relatively dry, scaly and often unclean skin offering inviting conditions for lice. Lice seldom remain long upon the animals after they are turned upon the succulent early grass in the spring. It is the popular opinion that the presence of lice upon any of the domestic animals is not to the credit of the owner, as it generally occurs amid careless, dirty, and impoverished conditions. But this is not always true, as lice may sometimes appear in unaccountable manner among conditions approaching the ideal.

TREATMENT—It should be known by those dealing with the condition that lice pass their entire life from generation to generation upon the body of the animals which harbors them, and that their spread is due to the rapid succession of the generations, facilitated by close association, grooming utensils, bedding etc. Though these parasites will only by accident leave their host, the litter of stables should be burned and all woodwork washed down with a five per cent. creolin solution, after which it is well to apply whitewash. These cleaning-up measures together with plenty of nourishing and succulent food, are first essentials to control and treatment.

As insecticides for application to infested animals there may be mentioned (1) decoction of tobacco, one ounce to the quart of water, (2) creolin, in three per cent. solution; (3) kerosene emulsified with milk or soap suspension, or (4) kerosene shaken up in linseed oil in the proportion of one part kerosene to two of oil. If a preparation containing tobacco is used, it should be applied over limited areas only in view of danger from possible nicotine poisoning. Oily preparations and ointments should likewise be restricted to not more than one-third of the skin's surface at one application.

Sodium fluoride, which has been recommended as highly effectual in the treatment of lice of poultry, should also be of value in the treatment of lice of mammals. This especially applies to cattle, as the treatment is only applicable to biting lice. The remedy should be well rubbed into the hair over all parts of the body.

Proprietary remedies for lice should be avoided unless the ingredients and their proportions are known to the user. In such a matter it is well to obtain unprejudiced and competent advice.

Where a large number of cattle are infested the only practical method of treatment is by dipping with ordinary sheep dip, or a lime and sulphur preparation may be used.

All measures of treatment and eradication should be repeated at least three times at intervals of eight to ten days.

SCABIES—In the Western state scabies is less frequently met with in cattle than in horses and sheep. Separately or co-existing upon the same animal, we may have three species of mites producing scab of cattle—*Sarcoptes scabiei* var. *bovis* (fig. 2), *Chorioptes communis* var. *bovis,* and *Psoroptes communis* var. *bovis* (fig. 4). The first burrows galleries beneath the outer layer of the skin and usually affects the skin about the eyes and cheeks, from where it may spread to the neck. It may first appear in the thin skin of the udder, especially that of the escutcheon. The second produces what is commonly known as tail mange, due to its usual appearance in the depressions at the base of the tail. It has little tendency to spread from this location.

Where cattle scabies occurs in this country it is usually the psoroptic form, due to the presence of the last named species. Psoroptes communis. It commonly makes its appearance upon the sides of the neck, spreading by coalescing areas to the sides of the body, advanced and neglected cases sometimes involving the greater part of the body.

From the onset of the disease the itching is intense and the skin becomes hairless, thickened and pustular, there is formation of crusts which, piling up layer upon layer, present the typical alterations of scabies. Due to the rubbing to relieve the intense itching, excoriations and ulcerous patches may appear, and, as the disease advances, the animal becomes emaciated, enemic, and much weakened. In this miserable condition it may die. Calves and yearlings suffer the most, and in severe outbreaks it is among these that there are likely to be the most fatalities.

The more serious cases usually occur during the latter part of the winter, the spread and severity of the disease being especially favored by crowded and warm quarters. Warmth always increases the irritation from the parasites, as under such conditions they are more active in their attacks upon the skin. With turning upon grass and the renewal of the coat the scabs fall away and the symptoms subside though the infection may remain.

If there is doubt as to the presence of true scabies, the diagnosis may be made sure by the recovery of the mite. This should be searched for in small quantities of material taken from the deeper layers of the scab, preferably at the margin of an affected area. The whole process can only be carried out by one trained in the use of the microscope and laboratory technique.

TREATMENT—The treatment of scabies of cattle can only be successfully carried out by one fitted by training and experience for the work. The preparation of the affected animals, selection of a

remedy for the destructions of the parasites, and the manner of its application will depend upon the extent of the affection and the number of head involved. If the herd is large and the condition has spread, it can only be handled by dipping every member of the herd. This requires the construction of a suitable dipping vat and the careful preparation of a dip, as lime and sulphur. Formula for dips with directions for their preparation may be obtained by veterinarians upon application to the Bureau of Animal Industry, Pennsylvania Department of Agriculture, Harrisburg.

The dipping is to be repeated upon the entire head in about two weeks, a fresh dip always being used. After dipping the same precautions should be taken against reinfection as directed for sheep.

Cattle which have been scabby during the close of the winter months, and which seem to have recovered during the summer upon grass, may still carry the infection in a latent form. As a matter of precaution against a repetition of the outbreak, therefore, it is well to again give treatment to these cattle when they are taken from pasture in the fall.

THE INTERNAL PARASITES.

As to the parasites of the intestinal and respiratory tracts, a number infesting sheep and cattle are of the same or closely related species. The stomach worm of sheep (*Hæmonchus contotrus*) also infest cattle, while a worm of the same genus (*Dictyocalus viviparous*) attacks the respiratory organs (fig. 4). As these worms make their most severe inroads upon the lambs, so in cattle the most serious consequence of their presence are among the calves.

Fig. 14.—Lung worm of cattle *(Dictyocaulus viviparous)*, male (right) and female (left) natural size. (Underhill's Parasites and Parasitosis, the Macmillan Co.)

Nodular disease of the intestines occurs in both sheep and cattle, in cattle caused by a worm (*Oesophagostomum radiatum*) similar in its natural history and mode of infection to that of sheep.

At least two species of tapeworms infest sheep and cattle in this country, and there are other species of parasitic worms which might be mentioned, as common to both.

In view of these similarities as to the most important of the worms infesting sheep and cattle, what has been said of them as they pertain to sheep, will in its essentials, apply to cattle as well. The symptoms, course, and prognosis are much the same in each case, though, in general, it may be said that lambs are more likely to succumb to parasitism than calves.

As has been stated under control of sheep parasites, low-lying, swampy areas should be avoided and movement to fresh pasturage made as frequently as practicable. It follows what has been stated as to parasites common to both that sheep and cattle cannot follow one another with safety in a system of pasture rotation. On the other hand, horses, swine and ruminants (sheep and cattle) may be pastured in turn upon the same fields with little risk from spread of the parasites.

PARASITES OF POULTRY.

There are numerous conditions which render poultry especially exposed to the spread of their parasites; their concentration in flocks, contact of their bodies upon the roosts, nesting and variously cared for feeding and watering utensils may be mentioned among these. Furthermore, their habit of devouring insects and other possible carriers of parasites is no doubt a contributing source of their frequent infestation.

THE EXTERNAL PARASITES.

The Gamasid Mite (*Dermanyssus gallinae*)—This is a little poultry mite common to poultry everywhere (fig. 15). It is very small, the adult female being not more than a thirty-second of an inch in length. The body is oval in outline and may be light gray in color, or red if engorged with blood. The legs are relatively long, and the sucking mouth parts extend forward.

Though poultry may be attacked during the day by these mites, especially while upon the nest, their most severe attack is during the night when they come forth from their day time retreats to swarm upon the fowls and suck their blood. The harmful effect upon the fowls is due to the extraction of a considerable amount of blood by the myriads of parasites and the annoyance and loss of rest due

to the extreme irritation. It follows, that, in accordance with the degree of the parasitism, there is more or less emaciation and loss in egg production. In heavy infestations chickens may die from loss of blood and emaciation.

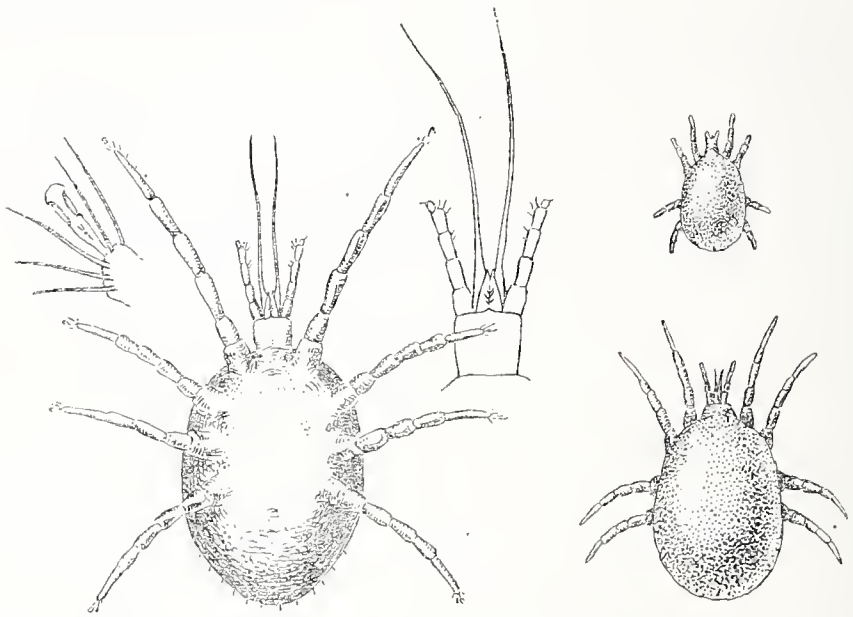


Fig. 15. —Poultry mite *(Dermanyssus gallinae)*; a, adult; b, terminal segments of leg; c, mouth-parts; d and e, young, all enlarged. (After Osborn, Bul. No. 5, Bu. of Entomology, U. S. Dept. of Agr.)

The Bedbug—(*Acanthia lectularia Linn*)—The common bedbug (fig. 16) or species related to that attacking man, may infest the quarters of domestic animals, the usual poultry house affording many harbors of retreat for these pests.

Like the gamasid mites, the bedbugs secrete themselves in darkened retreats during the day, coming out to attack their victims at night. After their feed of blood the insects return to their daytime seclusion where they remain for several days during which time their meal is digested.

The effect upon the fowls is similar to that from the gamasid mites; there is loss of rest while upon the roosts, falling off in flesh and egg production, and in heavy infestations chickens may die from emaciation and loss of blood.

The Fowl Tick (*Argas miniatus*)—This is a parasite of poultry met with over most of the world where poultry is kept, though in this country it is more common to the Southern United States. It is larger than either of the preceding mentioned, reaching a length of a quarter of an inch or more, with flattened body, egg-shaped in outline, the head at the narrower end in the adult concealed beneath the body-margin (fig. 17).

The larvae of the tick are very active and attack the poultry by day as well as by night. At this stage they attach to the body of their host where they remain for several days, feeding upon its

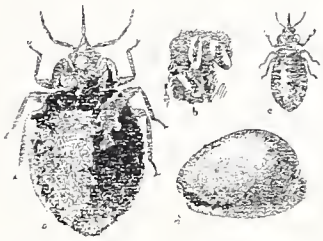


Fig. 16.—Bedbug, female gorged with blood; d, mouth-parts, all enlarged. (From Bul. 320, Ohio Agr. Exp. Sta.)

blood. They then detach and, secreting themselves in some convenient retreat, molt and enter the nymphal stage. At this and the adult stage the ticks come out of their daytime hiding places to feed upon the bodies of the poultry at night· in this respect resembling habits of the bedbugs and gamasid mites.

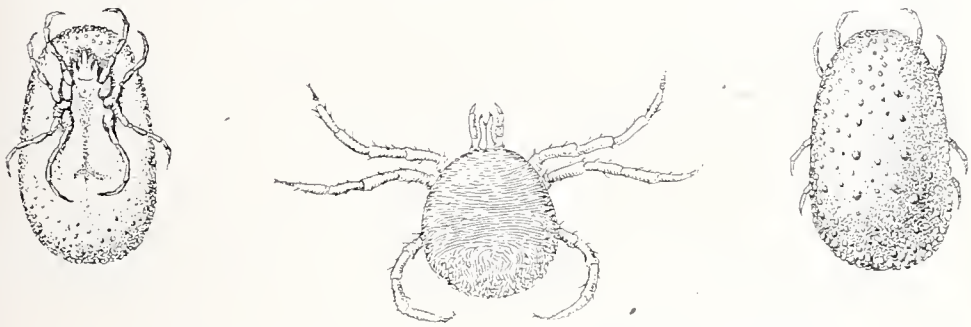


Fig. 17.—Fowl tick *(Argas miniatus)*, adult and larva *(center)*, enlarged. (After Osborn, from Marx, Bul. No. 5, Bu. of Entomology, U. S. Dept. Agr.)

The effect upon the poultry is similar to that from the last mentioned parasites.

CONTROL—Fowl ticks, bedbugs, and gamasid mites deposit their eggs in their daytime retreats, hatching occurring in about six days in the case of bedbug and gamasid eggs, while those of the ticks require three to four weeks. The gamasids especially thrive and multiply amid collections of filth. As to all of these, therefore, a first essential in eradicative measures is a clearing out, so far as practical, of everything that will afford a retreat and breeding place for the parasites. All collections of filth and trash should be removed and properly disposed of, nesting removed and burned, and

roosts taken from their supports. Loose bark affords an ideal harbor for the vermin, therefore no woodwork with the bark on should be permitted about the poultry houses or yards.

Much of such preventive detail applies to poultry parasitism in general and comes within the ordinary routine of the careful poultry keeper. Through numerous possible sources, however, parasites may find their way to his flock in spite of his vigilance. Frequent inspection of birds and premises is necessary and prompt detection followed by prompt action may avoid the invasion assuming the proportions of a problem.

After thorough cleaning up, interiors should be treated everywhere with an insecticide. Kerosene may be used, either by itself or emulsified with milk or soap suspension and applied as a spray. It is necessary to thoroughly wet down and drench all cracks and wooden fittings with the agent used. Fumigation, as with sulphur, is not to be depended upon. Formaldehyde is useless as an insecticide. The roosts before being replaced should be dipped in coal tar so that the tar will cover them for about eight inches from their supports, the application to be renewed at intervals as needed. This will repel the advance of the parasites upon the roosts.

These measures should be completed by one or two coats of whitewash applied hot and the throwing open of the entire premises to sun light and air so far as possible.

If continued freedom from the parasites is to be insured, the eradication measures are to be repeated at intervals of ten days for the mites and bedbugs and about one month for the ticks.

THE LICE—The poultry keeper need not consider it a reflection upon himself that he discovers lice upon his birds. It follows from the essential conditions under which fowls must be kept in domestication that few flocks can be entirely free from them.

The lice of poultry are not blood suckers, therefore, relative to their numbers, they do less harm than the ticks, bedbugs and mites which are vicious extractors of blood. On the other hand, the lice pass their entire life cycle upon the bodies of their hosts, never leaving them by day or night, unless by accident to crawl from the body of one bird to that of another. Varying with the degree of infestation, therefore, the lice are a constant source of annoyance and cause loss of flesh and egg production. Chicks especially suffer and not infrequently lose vitality to the extent of a fatal termination.

There are several species of lice peculiar to chickens, turkeys, ducks, geese and pigeons, respectively, which are not necessary to

enumerate specifically here, sufficient to say that all feed upon the products of the skin, their mouth-parts being adapted for chewing and not for piercing and sucking.

CONTROL—In the eradicative attack upon lice we have not to deal with eggs and young developing in darkened retreats about the quarters as in the case of the afore-mentioned pests. The lice are, however, often dislodged from their hosts and may for a time be harbored by nesting, roosting, etc., therefore thoroughness of treatment will demand the same measures applied to the quarters as recommended for the other skin parasites.

Under all conditions poultry should have free access to the dust bath, and, as this destroys the insects by plugging up their breathing pores, it will be most effectual when fine and penetrating. A mixture of road and lime dust, or fine ashes in which powdered sulphur is mixed, makes a very satisfactory wallow. The dust should be kept in boxes of ample size and placed where they will not get wet. Lime dust created by throwing handfuls of lime about the closed and empty hen house will be helpful in destroying not only dislodged lice but other insect pests which may be present.

As treatment for individual birds probably sodium fluoride is the most effectual agent which we have at present. The powder should be sprinkled under the feathers of the neck, breast, back, tail, below the vent, and upon the under side of the wings as these are spread. It may be applied as a dip prepared by adding one ounce of commercial sodium fluoride to the gallon of water. The solution should be moderately warmed and the entire body, excepting the head, immersed in it. About one pound of powder will be required for the treatment of one hundred birds.

In general it may be said that about one week is required for the hatching upon the fowls of the lice eggs. Therefore, to reach surviving generations, the treatment should be repeated in about ten days.

MANGE OF THE LEGS OR SCALY LEG—This condition is caused by a mite, microscopic in size, quite similar to the mites producing scabe in other animals (fig. 18). It is most apt to attack the legs of the heavier breeds of chickens, burrowing beneath the scales of the legs and toes. Its multiplication and the resulting irritation to these parts causes the formation of a lard-like deposit followed by the development of rough and unsightly crusts. As these formations increase there may be interference with the movements of the joints, causing the animal to often squat down, from which position it may be unable to rise (fig. 19).

TREATMENT—After softening the scabs with soft soap and soaking in warm water, they may be carefully removed by manipulating with the hands. When the parts are dry, apply an acaricide such as Peruvian balsam, or an ointment of one part carbolic acid to twenty parts of lard, may be used.

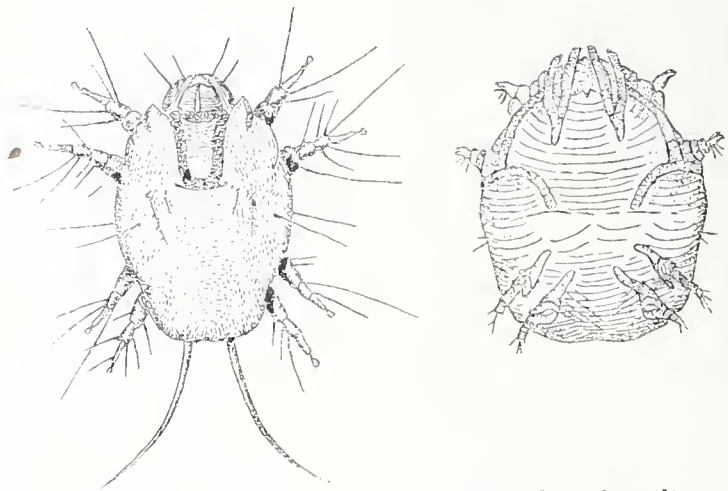


Fig. 18.—The parasite causing a scaly leg of poultry. *(Cnemidocoptes mutans)*, male (left) and female (right), enlarged. (After Osborn, No. 5 Bu. of Entomolgy, U. S. Dept. Agr.)

A treatment said to be effectual and especially applicable if a large number in the flock are affected, consists in dipping the feet and legs in kerosene. This should be repeated two or three times at intervals of about one week.

Fig. 19.—Foot of fowl affected with scaly leg. (From Bul. 320 Ohio Agr. Exp. Sta.)

DEPLUMING MANGE—Depluming or body mange of poultry is caused by a mite very similar to the one producing leg mange. It causes itching with the production of more or less scales upon the skin and through the feathers. The irritation impels the fowl to pluck at its feathers which easily fall out. The skin thus exposed is however, but little changed, usually appearing normal or but little thickened.

TREATMENT—Remedies used for the destruction of the mites may be the same as recommended for leg mange. If a large flock is affected they can be treated by dipping for several successive days in a sulphur bath. When the condition is present the feet of roosters should be repeatedly disinfected as a precaution against the infection being conveyed from the back of one hen to that of another.

THE INTERNAL PARASITES.

The TRACHEAL OR FORKED WORM (Snygamus trachealis)—The condition commonly known as gapes is brought about by the presence of this worm in the air passages. The disease is so-called because of a stretching of the neck accompanied by a yawn-like opening of the beak, which is a typical symptoms. The infestation is a serious one, and many losses may result from it, especially among young birds. It is usually accompanied by dullness and a progressive emaciation, the mouth becomes filled with a frothy saliva, there is difficulty in respiration, and the animal may die from suffocation or exhaustion.

The female of the worm causing the disease is about three-quarters of an inch in length. The male which has a length about one-quarter of an inch, remains attached to the female near the upper third of her body, from which peculiarity is derived the common name "Forked worm." (Fig. 20). The worms attach themselves by their mouth parts to the lining of the trachea where they suck blood and cause much irritation. The eggs are liberated either within the air passages or upon the ground, in either case by the rupture of the body of the mother worm. Birds may become infested by eating the expelled worm or by food or water contaminated with the eggs and embryos.

Fig. 20.—Tracheal or "forked worm" of poultry *(Syngamus trachealis)*, male (attached at left) and female, natural size. (Underhill's Parasites and Parasitosis, the Macmillan Co.)

CONTROL—Control measures call for the separation of affected birds from the apparently healthy. It should be especially looked to that watering and feeding utensils be thoroughly cleaned and scalded out each day, and that the food and water supply always

be fresh. Usual steps in the cleaning up and disinfection of housing and yards should be followed as in all cases of poultry infection.

The usual methods of treatment of affected birds, as by the insertion into the trachea of a feather dipped in some expelling agent, or fumigation, can only give partial or temporary relief. In view of this these methods are scarcely to be advised, especially as there is danger from suffocation in their application. The giving with the food of substances having a strong odor, as garlic or asafetida, has been recommended. These act by the odor eliminated in the respiratory organs, so affecting the worms as to cause them to be detached and more readily expelled. The main reliance, however, must be in the avoidance of all conditions contributing to the maintenance and spread of the infestation.

INTESTINAL WORMS—The intestines of poultry are frequently invaded by both roundworms (Fig. 21.) and tapeworms, either of which may be present alone or conjointly. The roundworm commonly found in the small intestine (Heterakis perspicillum) is about three

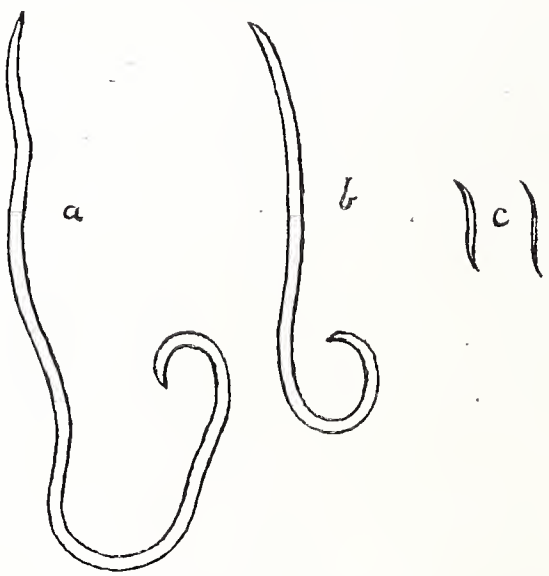


Fig. 21.—Intestinal worms of poultry; a and b *Heterakis perspicillum*, female and male; c, *H. vesicularis;* all natural size. (Underhill's Parasites and Parasitosis, the Macmillan Co.)

inches or more in length, the body white or yellowish white in color. It is inclined to wander and may be found in other parts of the body, even within the egg. Another species much smaller (H. vesicularis) is commonly found in the ceca which are the larger portions of the intestine. It is about one-half an inch in length. The small intestine may also be inhabited by several species of tapeworms.

Relative to their number, the roundworms and tapeworms bring about more or less malnutrition due to the irritation and inflammation which they cause to the intestinal lining and the absorbtion into the blood of poisonous products coming from the bodies of the worms. In general the symptoms shown will be drooping, erect and lusterless feathers, and more or less emaciation, though the appeitite may be preserved. In aggravated cases there is loss of appetite, diarrhoea, paleness of the comb, closure of the eyes, and a disinclination to move about. Such cases are likely to terminate in death.

These symptoms are not specific to worm infestation, and it should be made sure by careful post-mortem examination that other diseases, such as fowl-cholera, which may co-exist with the presence of worms, have not been overlooked.

CONTROL—The same measures recommended for the eradication of tracheal worms should be applied. Birds showing indications of infestation should be removed to clean dry quarters with plenty of light and all droppings should be frequently removed and buried or so treated as to destroy their contained worm eggs.

COCCIDIOSIS—The term "white diarrhoea" has been given to this disease, but it should not be confused with bacillary white diarrhoea which is a blood disease due to a bacterium. Coccidiosis or coccidial enteritis of chicks is a disease of the intestines caused by a microscopic, single-celled animal organism which attacks the cells lining the intestinal wall or those of organs leading from the intestines. The disease is most often met with in chicks under ten weeks old.

The symptoms presented do not differ from those of certain other diseases of poultry, and the diagnosis of coccidiosis can only be established with certainty by a laboratory examination of the organs of fecal material of the fowl for the detection of the coccidian. The symptoms are in their most prominent respects similar to those given for intestinal worms. Suggestive of coccidiosis is a whitish colored diarrhoea which soils and mats the feather below the vent. It is especially significant if this discharge is streaked with blood. In chicks death usually follows after a course of three or four days.

CONTROL—Though the affected chicks usually die, older chickens may carry the coccidian causing the disease and thus spread it about Infection is by food, water and soil contaminated by droppings which contain the coccidian in an encysted form. The cysts have considerable vitality, and it is claimed by some investigators that they may infect a year or more after they have been discharged from the harboring animal. All birds giving indications of the infection should be removed and the dead should be burned. It is probably

better economy to kill and burn all the sick. It is advisable to remove the entire flock to new quarters if possible, if not, the ground over which the birds run should be covered with lime and turned so it will be exposed to the sun and air.

BLACKHEAD OF TURKEYS—Among the diseases of turkeys to which the term "blackhead" has been applied is a severe inflammation and degeneration of the intestines and liver (Infectious Enterohepatitis), caused by a microscopic animal organism, somewhat similar to that referred to as the cause of coccidiosis.

The spread of the disease is by transmission from diseased to healthy birds through food and water contaminated by droppings. After the taking up of the infecting principle, there is, at the expiration of about four weeks, a loss of "pep" and appetite. Soon the animal droops and is disinclined to move about; there is diarrhoea of offensive odor, and emaciation and weakness progress. The comb and wattles show a blackish discoloration, and it is from this that the disease takes its common name through there are other disease of fowl in which this symptom occurs.

Adults may survive the attack, though a prolonged period may intervene before complete recovery. Recovery in young birds is rare; most all die from the disease after a course of about one week.

Search for the infecting organism to confirm the diagnosis can only be properly carried out by examination of the organs in a laboratory.

CONTROL—Measures of control are the same as those recommended for coccidiosis.